Best Management Practices Info Sheets

This chapter provides information on how to implement several best management practices discussed in Chapter 3. It also provides information on available water quality treatment facilities.

Table 4.1 below lists the BMPs that are discussed in this chapter. The BMP Info Sheets are divided into two sections: Source Control and Water Quality Treatment. The Source Control section includes BMP Info Sheets 1-7. The Water Quality Treatment Section includes BMP Info Sheets 8-15.

| TABLE 4.1 BMP INFO SHEETS | | |
|------------------------------|---|--|
| No. | TITLE | |
| 1 | Illicit Connections | |
| 2 | Disposal Options | |
| 3 | Covering Options | |
| 4 | Pave Area and Slope to Holding Tank | |
| 5 | Containment and Elevation | |
| 6 | Integrated Pest Management | |
| 7 | Catch Basin Cleaning | |
| 8 | Oil/Water Separator | |
| 9 | Catch Basin Insert | |
| 10 | Catch Basin Sump and Vault Filter | |
| 11 | Leaf Compost Filter | |
| 12 | Wet Pond, Wet Vault, or Constructed Wetland | |
| 13 | Vegetated Biofilters | |
| 14 | Sand Filter | |
| 15 | Infiltration | |

See Chapter Five--Other Agency Requirements and Chapter Six--Technical and Financial Assistance for other useful information to assist you in implementing the best management practices on your site.

Source Control BMPs

The following BMP Info Sheets discuss a variety of source control BMPs and other methods used to prevent, control, and dispose of pollutants. Source control BMPs prevent pollutants from contaminating stormwater runoff or entering water bodies. Some source control BMPs are operational, such as reducing the frequency of a polluting activity, checking regularly for leaks and drips, and educating employees about site clean up procedures. Other source control BMPs use a structure to prevent rainwater from contacting materials that will contaminate stormwater runoff. Examples of these BMPs include a berm or containment structure to prevent clean stormwater from entering work areas, or a roof over a storage area. A source control BMP can also include altering or revising your industrial process to use less of a contaminating substance in the first place.

The goal of King County's program is to reduce the contamination of water resources through emphasis on source control BMPs. The following BMP Info Sheets provide more detail information on how to implement some of these source control BMPs.

Illicit Connections

An illicit connection is a connection that could convey anything not composed entirely of surface and storm water directly to the storm drainage system or a water body. Many buildings throughout King County may have illicit connections to the storm drainage system. These typically include, but are not limited to, sanitary sewer pipes, process waste water discharges, sump overflows, and internal building drains connected to the storm drainage system. As a result of illicit connections, waste water containing a variety of pollutants is discharged directly to storm sewers and drainage ditches, and ultimately to receiving waters rather than to the sanitary sewer system or septic system. In many instances these connections are unknown to the business, and may not even show up on building drawings. Elimination of illicit storm drainage connections is an important facet of a stormwater pollution reduction program and must be addressed as a top priority. King County is currently making a committed effort to determine where illicit connections are present and to require their removal.

FINDING AN ILLICIT CONNECTION

All businesses and public agencies in unincorporated King County must investigate their plumbing systems to determine if there are any illicit connections to the storm drainage system, such as internal floor drains plumbed to the storm drainage system. If building and property drawings are available with plumbing details, they should be reviewed to understand pipe connections.

If you are unsure weather a particular drain (such as a floor drain) discharges to the storm drainage system, you have two choices. The first is to assume it does and permanently plug the drain or connection. This would be the easiest and most cost effective solution. The second is to correctly identify where the connection drains by consulting plans, side sewer cards and possibly conducting a dye test. This option can be time consuming and costly.

Any pipes or other conveyances connected to storm drainage facilities that drain anything but stormwater must be permanently plugged or rerouted to a sanitary sewer, holding tank, on-site process treatment system, or septic system (with approval).

If building plans and side sewer cards do not show your plumbing, the most basic method for determining a connection is dye tracing. A non-toxic dye of obvious color, such as red, can be put in water and flushed or drained into suspect piping. Observations should then be made in manholes, drainage ditches, or whatever other storm drainage conveyances are present on site (or adjacent to the property) to search for the dye. Enough water must be

poured or flushed through the indoor drain to force the flow to reach the point(s) of observation. If possible, all other drains in the building should be out of use while the dye test is conducted to ensure the results can pinpoint the problem drain. This test should be conducted for each suspect drain on the property. Any observations of dye in the storm drainage system must be noted and the corresponding indoor drains tagged for follow-up pipe plugging or rerouting.

If there is uncertainty as to the locations of manholes which can be used for observation, or how storm drainage is achieved for a property, King County staff should be contacted for assistance in defining the storm drainage system characteristics for the site. King County Surface Water Management must be notified of a dye test at least one day in advance of testing.

ELIMINATING AN ILLICIT CONNECTION

Drains and pipes which are found to connect to the storm drainage system must either be permanently plugged or disconnected and rerouted as soon as possible. Drains that are no longer needed can be plugged with concrete or similarly effective materials. Whenever the diversion of any process water, stormwater, or other waste water to the sanitary sewer is the required or chosen BMP, the local sewer authority and the King County Department of Metropolitan Services (Metro) must be contacted to obtain approval prior to commencement of discharges to the sanitary sewer. The local sewer authority and Metro must also be contacted prior to the installation of any permanent connection to the sanitary sewer. The name of your local sewer authority is identified on your water and sewer billing. The local sewer authority and Metro will regulate the connection both for discharge quantity and quality, but the responsible party will have to arrange for the necessary plumbing supplies and pipe disconnection/rerouting work.

If the property is not serviced by a sanitary sewer, and one is not available nearby for a hookup, alternative measures are necessary. If the discharge is domestic waste water from a toilet, sink, appliance, or shower/bathtub, a septic system can be used to receive the rerouted discharge. The connection of plumbing fixtures to an on-site sewage disposal system usually requires an on-site sewage disposal system repair permit. Therefore, before pipes are rerouted, the Seattle-King Department of Public Health must be contacted for further information. If a septic system is not present on the property, then one should be installed. If this is the case, the Seattle-King County Department of Public Health should be contacted for advice and information on septic system requirements. If the discharge is industrial process water or other non-domestic waste water, a holding tank or on-site treatment system will be needed. If an illicit connection needs to be rerouted to a holding tank, King County staff should be contacted for assistance and information on tank content disposal requirements. As with septic system and sanitary sewer hookups, the property owner or responsible business operator is responsible for rerouting the illicit pipe connections.



Disposal Options

Every business and public agency in King County must dispose of solid and liquid wastes and contaminated stormwater properly. There are generally five options for disposal depending on the types and quantity of materials. These options are: (1) sanitary sewer system, (2) septic system, (3) recycling, (4) municipal solid waste disposal facilities, and (5) waste transportation and disposal services. Ordinary stormwater runoff is not considered to be contaminated to the point of requiring special disposal. Stormwater that is mixed with concentrated wastes requires special disposal, as discussed below.

DISCHARGE TO SANITARY SEWER SYSTEM

Process waste water (depending on the pollutants and associated concentrations present) can be put into the sanitary sewer, subject to approval by the local sewer authority and the King County Department of Metropolitan Services (Metro). Animal waste can be disposed of in a sanitary sewer, subject to loading capacity constraints. The King County Department of Metropolitan Services may require that all stormwater discharged to a sanitary sewer be metered. Sewer fees may be collected on such discharges.

The first priority is to discharge process water to a sanitary sewer via an existing plumbing connection or a new pipe connection. Whenever the diversion of any process water or other waste water to the sanitary sewer is the required or chosen BMP, the local sewer authority and Metro must be contacted to obtain approval prior to commencement of discharges to the sanitary sewer. Pretreatment of discharges to remove some of the process water pollutants may be required as a condition of discharging to the sanitary sewer. The local sewer authority and Metro must also be contacted prior to the installation of any permanent connection to the sanitary sewer. The name of your local sewer authority is identified on your water and sewer billing. See Chapter 5 for more information on sanitary sewer authority requirements.

If you can not discharge to a sanitary sewer system, sumps or other temporary storage devices may be useful for storing liquid wastes on a temporary basis. Consideration should be given to using a holding tank for used process water if the volume of process water generated by the activity is not excessive. See BMP Info Sheet 4 for more information on holding tanks. The contents of the holding tank must be pumped out or drained before the tank is full. Several commercial services are available for pumping out sumps and holding tanks. These can be found in your telephone directory's yellow pages under the headings "Sewer Contractors" and "Tanks Cleaning." Septic system pump-out and hauling contractors must not be used for disposing wastes other than domestic sewage. They are not

allowed to haul industrial wastes.

Currently stormwater is prohibited from being discharged to the sanitary sewer, however, Metro is developing rules that may authorize the discharge of contaminated stormwater from certain types of industrial activities under certain circumstances.

DISCHARGE TO SEPTIC SYSTEM

If your site is not serviced by a sanitary sewer system, you probably have a septic system. Only liquid waste that is comparable to residential sewage in strength and constituency may be disposed of in septic systems. Hazardous chemicals cannot be disposed of in septic systems. Further, the septic system must be designed to accommodate the volume of suitable waste water generated. Any changes in waste volume and constituency from those present when the system was permitted must be approved by the Seattle-King County Department of Public Health. Stormwater, whether contaminated or not, may not be disposed of in septic systems. Animal waste may not be disposed in a septic system.

RECYCLING

Recycling facilities are a recommended option for many commercial items, including used oils, used batteries, old equipment, a variety of used auto parts, metal scrap materials, solvents, paints, and various other solid wastes. There are a number of private businesses that accept materials for recycling. In addition there is an Industrial Material Exchange clearinghouse which facilitates the transfer of unwanted materials from the generator to another business that can use them.

Process waste water such as wash water can be recycled on-site as an alternative to discharge to sanitary sewer. There are numerous products on the market to recycle wash water.

See Chapter 6 for more information.

MUNICIPAL SOLID WASTE DISPOSAL FACILITIES

Municipal solid waste disposal facilities are designed to handle solid wastes. Hazardous and dangerous wastes and many liquid wastes must be properly disposed of at an appropriate facility. Contact your local landfill for information on materials accepted at the facilities. The Business Waste Line at (206) 296-3976 can provide information on disposal of oil, antifreeze and other hazardous wastes.

WASTE TRANSPORTATION AND DISPOSAL SERVICES

There are numerous services that can help you identify, quantify, transport, and dispose of waste that you may generate. Many people have their wastes picked up by a disposal contractor.

Costs of disposal vary considerably depending on the types of materials, quantities, methods of collection and transport, and whether the wastes are mixed. The rate the contractor charges will generally reflect the costs of testing and/or treating waste materials (if necessary) and subsequent disposal. It is important to keep different types of wastes separated, so that the disposal contractor(s) can take them to the appropriate place(s) without causing inadvertent contamination problems elsewhere, and so that you are not paying too much for disposal of materials that are not contaminated (e.g. regular garbage). If you are doing a good job with BMPs and collect contaminated waste materials for proper disposal, your efforts are compromised if a disposal contractor subsequently disposes the contaminated materials as regular garbage. Therefore, it is essential to be familiar with disposal alternatives and the different types of contractors for each disposal option.

The Seattle-King County Department of Public Health's Waste Characterization Program serves hazardous waste generators in Seattle and King County that have questionable wastes. Information supplied by the generator on questionable wastes such as sludges, sandblast waste, treated wood, and contaminated soils is reviewed by the Health Department. Permits are issued for those wastes that will be allowed in the garbage. The dangerous waste regulations as well as other criteria are used in the decision process.

The disposal of wastes is the responsibility of the generator. Before agreeing to let a company handle your waste, it is recommended that you ask for (and check) the company's references. All waste collected by the company should be delivered to an authorized site. Make sure you keep copies of all your transactions.

Covering Options: Tarp, Roof, or Awning

One of the most effective actions a person can take to prevent stormwater contamination is keeping potential pollutants out of the rain. There are numerous options for covering an activity. This BMP, combined with prevention of stormwater run-on into the covered area, can be as effective as indoor enclosure.

The simplest cover is the use of tarps or other non-structural devices. Any building of structures requires a building permit and must comply with applicable building and fire codes. These building requirements may, in some cases, make some of these structures too

expensive to be practical. Contact the King County Department of Development and Environmental Services for information on building permits and requirements for a roof structure.

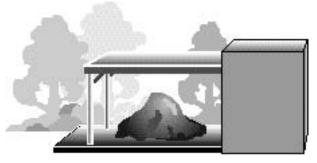
Many activities, such as stockpiling of raw materials or storage of drums, can be effectively covered with a heavy plastic tarp made of impermeable material. Weights such as bricks, tires, or sandbags should be used to anchor the cover in place. Care should be



taken to ensure that the tarp covers the activity completely and that stormwater run-on does not penetrate significantly under the cover. If several tarps are used to form a cover, they should be tethered together or laid in an overlapping manner. If necessary, pins or stakes should be used to anchor the tarps to the ground. The tarp covering will be easier to keep in place and will last longer if some form of wind protection is possible. Attempts should be made to locate stockpiles in areas where winds are minimal.

The tarps must be in place when the material is not being used. The tarps must be inspected weekly to ensure that no holes or gaps are present. Tarps are inexpensive, and therefore are a cost-effective BMP for many activities. This BMP can be combined with containment for better effectiveness. See BMP Info Sheet 5 for more information.

The other option for covering is the use of a roof structure. The particular roof cover option used at a given site is subject to the site layout, available space, affordability, and limitations imposed by other regulations. The area of the roof cover should be sufficient to prevent any precipitation from reaching the protected contents underneath. This BMP should usually be implemented in conjunction with prevention of stormwater run-on into the covered area. BMP Info Sheet 5 presents information on containment/run-on prevention. Examples of various structures are shown below.



Lean-To Structure

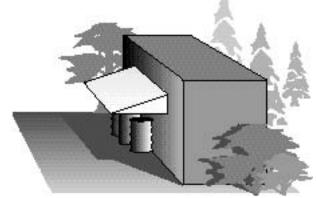


Stand-Alone Canopy

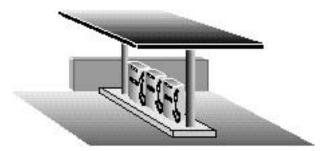
There are also numerous prefabricated storage sheds that can be purchased to enclose and cover materials. This may be a preferred alternative on some sites. Again, before purchasing these structures ensure they meet applicable building and fire codes.

Another option for covering an activity is to use an overhanging awning of sufficient size to prevent precipitation from reaching the contents underneath. This cannot be an awning already in place over a public right-of-way such as a sidewalk in front of a store. Many of the building permit, fire code, and zoning code requirements mentioned above apply to these structures also.

Activities such as fueling operations may be conveniently covered by an island-type overhanging roof. This roof arrangement is supported by columns along the center of the structure rather than at the corners, enabling vehicular traffic underneath while still providing sufficient protection from precipitation.



Overhanging Awning



Island-Type Overhanging Roof



Pave Area and Slope to Holding Tank

This BMP applies to several activities that cannot be covered effectively, and therefore require a method of controlling off-site runoff that may be contaminated. It is particularly suited to activities with the potential for spills and leaks, but otherwise do not generate excessive amounts of polluted runoff. In addition, this BMP is well suited to activities that intermittently produce waste water such as washing operations. A sump or holding tank serves to provide spill containment until the liquids can be pumped out and properly disposed. If the activity produces large amounts of runoff, this BMP will not be very effective because the stray contaminants will overflow the sump or pass through the sump before collection and disposal are possible. The following implementation information is intended for situations where this BMP can be effective.

A designated activity area should be paved and sloped to drain to a central collection point. A sump, vault, or holding tank should be installed underneath this collection drain. Some materials, such as gasoline, can react with asphalt pavement and cause the release of toxic oils from the pavement. It is preferable for the area to be paved with portland cement concrete. If the area is already paved with asphalt, an asphalt sealant should be applied to the pavement surface. Whichever paving material is used, the paved surface must be free of gaps and cracks.

The sump or holding tank should have a large enough capacity to contain the entire volume of waste water generated by the activity, or the entire volume of a potential spill (whichever is applicable, or the greater of the two). Depending on the circumstances, the sump or tank can be equipped with an outflow pipe to allow discharge of normal, uncontaminated runoff to the storm drainage system. The local sewer authority may, in some instances, allow a connection of sump outflow to the sanitary sewer system. This is unlikely, but may be a consideration.

The paved activity area must also be contained to prevent stormwater run-on and run-off. This can be a curb, dike, or berm or similarly effective impediment to run-on, or intercepting storm drains (see BMP Info Sheet 5 in this chapter for more information). This way only the precipitation that falls within the activity area is discharged and/or treated along with the activity process water.

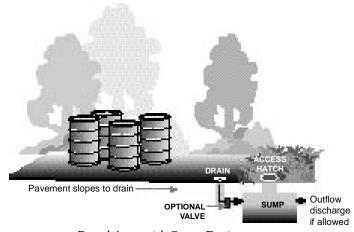
The drain pipe can have a two-way valve in it so that uncontaminated runoff from the activity area can discharge to the storm drainage system at times when the activity is not occurring. The two-way valve can therefore switch between discharges to the sanitary sewer, holding tank, or treatment facility, and discharges to the storm drainage system. Each time the activity is occurring, the two-way valve must be switched so that the site runoff discharges to the sanitary sewer, holding tank, or treatment facility. After the activity

operations are finished and no more process water is generated, the area must be sprayed, hosed, or otherwise washed down with the runoff going to the sanitary sewer, holding tank, or treatment facility. The two-way valve must be switched after site drainage is complete so that subsequent runoff is discharged to the storm drainage system until the next time the activity occurs. It is critical that careful attention be given to this valve so that it is always switched to the correct position. Approval for discharges with a two-way valve should be obtained from the King County Department of Metropolitan Services (Metro).

If discharges to the storm drainage system or sanitary sewer are not allowed, the sump or holding tank contents will need to be pumped out periodically and disposed of properly. This requirement can make this BMP costly, especially during the wet season. See BMP Info Sheet 2 for disposal options.

An example of a paved activity area with a sump drain is shown to the right.

Drainage into the sump or holding tank should only occur at times when the activity is occurring. To keep disposal costs down, a drain cover, plug, or shutoff valve in the pipe leading to the sump should be used at times when the activity is not occurring. Before starting the activity (if the activity is intermittent), the cover, plug, or valve must be opened.



Paved Area with Sump Drain

The cost of constructing a sump and disposing of accumulated contents can be high, so businesses should consider whether other allowable BMP alternatives can be used. Additional fees are charged by individual cities and Metro if a sanitary sewer hookup is made. The fees depend on location, quantity of discharge, and whether the hookup is for a business or residence. A Metro industrial waste permit may also be required in some situations.

Several commercial services are available for pumping out sumps and holding tanks. These can be found in your telephone directory's yellow pages under the headings "Sewer Contractors" and "Tanks Cleaning." Septic system pump-out and hauling contractors must not be used for disposing wastes other than domestic sewage. They are not allowed to haul industrial wastes.

Containment and Elevation: Surround with Dike or Berm, or Elevate

This set of BMP options can be an effective means for prevention of stormwater run-on to a contaminated activity area and for containment of spills in the activity area. This BMP may be less expensive to implement than paving the activity area and providing proper drainage collection, but can also be more difficult to maintain if stormwater ponding occurs inside a containment dike.

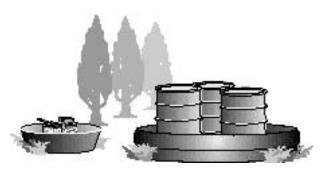
If a curb, berm, or dike is used to prevent stormwater run-on to a covered activity area, and the activity area is paved or otherwise impermeable, it should be placed underneath the covering so that precipitation will not pond inside it. In some instances, run-on prevention can be accomplished by placing containment materials on up-slope sides of the activity area. Stormwater run-on can also be prevented by elevating the activity with a platform or other type of pedestal.

Containment may be achieved with concrete curbing, an earthen berm, a tub such as a plastic wading pool, or some other dike material, depending on the activity, its size, and resources available. If a curb, berm, or dike is used to contain possible spills, and other containment sizing regulations (such as fire codes or Washington State Department of Ecology requirements) do not apply, it should be sized to hold a volume of 110% of the volume contained in the tank/containers.

Containment without a cover means water will accumulate in the area during and after rain. Any contaminated water cannot simply be drained from the area; it must be collected and disposed of either in a sanitary sewer, a stormwater treatment system, or at a licensed disposal facility. During the wet season, this course of action can lead to frequent draining requirements that may prove costly. In addition, some type of monitoring may be needed to determine if the water is contaminated. If the stormwater is typically clean, or if a stormwater treatment system is present on-site, a valve should be installed in the containment dike so that excess stormwater can be drained out of the activity area and directed either to storm drainage facilities (if clean) or into the stormwater treatment system (if contaminated), whichever applies. This valve should always be kept closed unless excess stormwater is being discharged, so that any spills that occur within the activity area can be effectively contained. Local sewer authorities and the King County Department of Metropolitan Services will probably not allow discharges from a large containment area into the sewer system. Therefore, containment in conjunction with a sanitary sewer hookup is usually not applicable to large sites.

fencing (filter fabric), concrete curbing, ecology blocks, compacted earth with grass planted on it, or similarly effective materials. Timbers treated with creosote or other preservatives should not be used because they can leach contaminants into runoff. If undesired ponding will occur due to a sturdy dike, filter materials should be used instead. All filter materials used around stockpiles must be maintained to work effectively and must be replaced when necessary.

For storage of small items, the simplest containment device is a tub or wading pool. A rubber or plastic children's wading pool may be sufficient for some activities that do not require a lot of space, such as storing remodeling and painting materials, and temporary



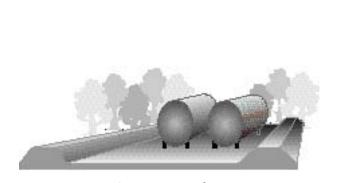
Simple Containment Devices

storage of wastes in drums. These small storage devices should also be covered with a tarp or other cover. An example of this is shown to the left.

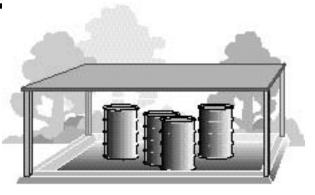
It should also be noted, with caution, that neglect and poor maintenance can render the containment useless. Maintenance of containment devices has to be stressed as essential for them to work as intended.

Commercial products are available that are a combination containment box/elevated pedestal. These devices prevent stormwater run-on by elevating containers of liquids (such as drums) off the ground and collecting spills and drips inside the pedestal box.

Integrated Pest Management



Containment Dike



Containment Curb

Integrated Pest Management

Use of herbicides, insecticides, fungicides, and rodenticides can be extremely harmful to the environment due to the highly toxic nature of many chemicals in pesticide products. In light of this, special attention should be given to pesticide usage in all applications. The discussion below applies more to large-scale pesticide users, but should be considered for backyard applications as well.

Commercial, agricultural, and other large-scale pesticide users such as golf courses and parks should adhere to the principles of integrated pest management (IPM), a decision-making process for pest management that strives for intelligent, environmentally sound control of pests. It is a systems approach to pest management that combines agronomic, biological, chemical, and genetic information for educated decisions on the type of control(s) to use, the timing and extent of chemical application, and whether non-chemical means can attain an acceptable level of pest control.

IPM is a preventive measure aimed at knowing the exact pest(s) being targeted for control, the locations and times when pests will pose problems, the level of pest-induced damage that can be tolerated without taking action, the most vulnerable life stage, and control actions that are least damaging to the environment. The major components of IPM are as follows: monitoring and inventory of pest populations, determination of pest-induced injury and action levels, identification of priority pest problems, selection and timing of least toxic management tools, site-specific treatment with minimized chemical use, and evaluation and adjustment of pesticide applications. Monitoring of pest populations is a key to successful IPM implementation. Pest problems are universally easier to control if the problem can be discovered early. With IPM pesticides are used only as a last resort; maximization of natural controls, including biological controls and removal of pests by hand, is a guiding rule.

Clean Catch Basins

Many commercial, industrial, and public agency properties have underground storm sewer drainage systems with catch basins as key components. Catch basins are typically located along curbs, under low spots in parking lots, and where sewer pipes combine flows. Storm drains visible on the surface collect runoff for catch basins that are typically located directly underneath them. Most catch basins have a few feet of storage in the bottom that never drains to an outflow pipe. This permanent storage area is intended to trap sediments, debris, and other particles that can settle out of stormwater, to prevent clogging of downstream pipes and washing of these solids into receiving waters.

Anyone who has ever looked into a catch basin can attest to its ability to capture dirt, leaves, twigs, litter, and a variety of other materials that make for a mucky buildup in the bottom. However, if the sump in the bottom is full of solid material, everything in the incoming runoff passes straight through to an outflow pipe. The bottom (or sump) in catch basins must be cleaned out periodically so they can continue to trap solids in runoff. Routine maintenance practices at all sites with storm drains and catch basins must include cleaning of these important drainage system features. If catch basins are not cleaned, they can actually contribute to receiving water pollution problems as trapped solids and stagnant, polluted water in sumps can be flushed out in large quantities with turbulent storm flow conditions.

Check your catch basins regularly for needed maintenance (at minimum once per season). As a rule of thumb, catch basins must be cleaned out when the solids, trash and debris in the sump at the bottom reaches one-third of the depth between the bottom of the sump and the bottom (invert) of the lowest inflow or outflow pipe connected to the catch basin. This is the level at which flushing of pollutants can be a problem. The rate at which a sump fills with solid material is quite variable, and depends on the characteristics of the drainage basin feeding into it. If activities that generate a lot of sediments are taking place in the drainage area feeding a catch basin, such as stripping soils bare, stockpiling erodible raw materials, and washing of vehicles and other equipment, the sump will obviously fill up relatively quickly. Therefore, sites with activities generating a lot of sediments and other debris will have to clean out their catch basins more often.

If you clean the catch basin yourself, you may dispose of up to one cubic yard of catch basin material as solid waste in your regular garbage. If you exceed this threshold you are encouraged to contact a company offering catch basin cleaning services. You can locate a cleaning service by calling King County SWM at 296-1900 for a list of firms performing drainage system maintenance services or in your telephone directory's yellow pages under headings like "Sewer Cleaning Equipment and Supplies," "Sewer Contractors," and "Tanks Cleaning." All of the solids and stagnant water collected from catch basin sumps

must be disposed of properly. None of the sump contents can be flushed into the catch basin outflow pipe. Depending on the nature of the pollutants in the sump, and the associated types of activities taking place on the site, the sump contents may need to be disposed of as hazardous waste. Contractors who perform catch basin clean-out services are required to follow appropriate disposal requirements.

Frequent sweeping of activity areas, covering activity areas, reducing activity occurrence, and containing runoff from activity areas will help reduce catch basin cleaning frequency, and probably save time and money spent on catch basin cleaning. All businesses and public agencies should set up maintenance schedules for all of their BMPs so that coordinated BMP maintenance efforts result in reduced catch basin cleaning necessity.

BMP INFO SHEETS 8-15

Water Quality Treatment BMPs

The following BMP Info Sheets discuss a variety of water quality treatment facilities used to treat stormwater runoff. Treatment BMPs are usually complex structures that treat the stormwater to remove contaminants. Most treatment facilities require careful planning, design, and construction and no facility is capable of removing 100 percent of the contaminants in stormwater. Because of this, source control BMPs, as presented in Chapter Three, should always be considered first.

The BMP Info Sheets describe the water quality treatment facilities including the applicability, maintenance, and design considerations of each. Design and construction details are deferred to either the *King County Surface Water Design Manual* (which contains relevant information for the treatment BMPs discussed), or to a private vendor specializing in the treatment system.

Businesses and agencies are allowed to select a treatment BMP other than those presented in this manual if they follow the variance process as outlined in the King County Surface Water Design Manual.

Table 4.2 (next page) presents a brief description of each water quality treatment BMP discussed in the info sheets. Table 4.3 presents the appropriate water quality treatment BMPs for removing specified pollutants. One treatment BMP usually cannot treat all pollutant problems. Each BMP is designed for a specific purpose and is capable of removing only specified pollutants. If you decide to install a water quality treatment BMP, always ensure that it is removing the pollutant of concern from your site runoff.

| TABLE 4.2 WATER QUALITY TREATMENT BMPs | | | |
|--|---|--|--|
| TREATMENT BMP | BRIEF DESCRIPTION | | |
| Oil/Water Separator | An underground vault specifically designed to remove oil and grease. Also will remove floatables and some settleable solids. | | |
| Catch Basin Insert | A filtering device that is installed within a catch basin and uses various sorbent materials and settling space to collect pollutants. | | |
| Catch Basin Sump and Vault Filter | A device similar to catch basin inserts, only larger and placed underground. | | |
| Leaf Compost Filters | A filtering device that is installed above or below ground and uses leaf compost to remove pollutants from stormwater. | | |
| Wet Pond, Constructed Wetland, Wet Vault | A wet pond is a stormwater pond that retains a permanent pool of water. A constructed wetland is similar to a wet pond, but shallower and supporting wetland vegetation in large areas. A wet vault is an underground, covered, engineered structure that retains a permanent pool of water. | | |
| Vegetated Biofilter - Biofiltration Swale and Filter Strip | A biofiltration swale is a long, gently sloped ditch or depression designed to treat water as it passes through the vegetation. Grass is the most common vegetation. A filter strip is a grass area, wider than biofilters, also with gentle slopes. Water usually enters as a thin sheet flow from the adjoining pavement. | | |
| Sand Filter | A structure placed in the landscape, with grass grown on top, or in vaults. Stormwater passes through the sand allowing particulate pollutants to be filtered out. | | |
| Infiltration | A normally dry basin which temporarily stores stormwater until it soaks through the bottom and sides of the basin, and infiltrates into surrounding soil. | | |

| TABLE 4.3 APPROPRIATE USES FOR WATER QUALITY TREATMENT BMPs | | | |
|--|---|--|--|
| POLLUTANTS TO REMOVE | APPROPRIATE TREATMENT BMPs | | |
| Oil/grease Sources: vehicle and equipment areas, industrial areas, food preparation | Oil/water separators; catch basin inserts; catch basin sump/vault filters, leaf compost filters. | | |
| Sediments/Solids Sources: sand/gravel storage, construction sites, unpaved areas, agriculture/livestock uses | For coarse sediments - Wet pond/vault; constructed wetland (with forebay); vegetated biofilter; sand filter; catch basin insert; catch basin sump/vault filters; leaf compost filters. For fine sediments - Wet pond/vault; constructed wetland (with forebay); vegetated biofilter; sand filter. Also see catch basin sump/vault filters. | | |
| Phosphorus Compounds Sources: detergents/cleaners, fertilizers, organic matter, animal wastes | For particulate phosphorus - Wet pond/vault; constructed wetland (with forebay); vegetated biofilter; sand filter. If dissolved phosphorus must also be removed - a large "oversized" wet pond or sand filter. | | |
| Nitrogen Compounds Sources: fertilizers, animal wastes, organic matter | For particulate nitrate - Wet pond/vault; constructed wetland (with forebay); vegetated biofilter; sand filter. For dissolved nitrate - constructed wetland. | | |
| Metals Sources: industrial areas, vehicle and equipment areas, paints, pesticides | For particulate metals - Wet pond/vault; constructed wetland (with forebay); vegetated biofilter; sand filter. For dissolved metals - leaf compost filter or constructed wetland. | | |
| Fecal Coliform Bacteria Sources: animal wastes; fertilizers | There is no treatment BMP that can reliably reduce fecal coliform bacteria to acceptable levels. Some studies have shown constructed wetlands provide some benefit. | | |
| pH Sources: metal plating, printing/ graphic industries, cement/ concrete production, cleaners | A constructed wetland can neutralize some ranges of pH | | |
| BOD and Trace Organics Sources: organic debris, food wastes, some chemical wastes | For particulate BOD - see "particulate nitrate" above. For dissolved BOD - A constructed wetland will remove some dissolved BOD and trace organics; more reliable performance requires activated carbon. | | |

Oil/Water Separator

APPLICATION AND DESCRIPTION

An oil/water separator is a device designed to remove oil, grease, and similar floatable pollutants from stormwater runoff. The name commonly refers to an underground vault structure, however, more simple designs exist.

Oil/water separators are appropriate at locations where petroleum products and/or byproducts cannot be effectively controlled with source-control BMPs. An oil/water separator can be a simple tee section in a catch basin that traps floating materials, or a complex unit that is more expensive and maintenance-intensive.

For many sites, such as small parking lots, a simple tee section in a catch basin will temporarily retard pollutants, making it possible to clean up a spill before pollutants leave the site. On sites with greater potential for oil spills and high concentrations of oil and grease in runoff, such as a fleet vehicle lot, auto repair shop, or fueling station, a more complex oil/water separator is needed.

Simple tee sections can be placed in catch basins in the primary conveyance system. Because of their simplicity, there are few restrictions on their application and locations of use.

There are two types of complex oil/water separators commonly used in situations where oily runoff is a significant concern: the American Petroleum Institute (API) and the coalescing plate interceptor (CPI). The API separator has the appearance of a long septic tank. An API separator must be large relative to the area it is treating to be effective. By placing coalescing plates in the separator, its size can be significantly reduced while retaining the efficiency needed. Consequently, the CPI separator is more commonly used. The relatively high cost of the plates is offset by the savings from reducing the cost of vault construction.

These oil/water separators should be used for targeted pollutant removal in heavily oiled areas rather than as an all purpose stormwater treatment facility. The separator will function more efficiently and require less maintenance if the amount of stormwater passing through is limited. Only runoff that has been exposed to high oil activity areas should be directed through the oil/water separator. Avoid directing stormwater (from other areas on your site) through the separator.

For information on oil/water separators for discharges to the sanitary sewer, contact Metro's Industrial Waste Section to obtain copies of the Oil/Water Separator Fact Sheet.

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DESIGN AND MAINTENANCE

Oil/water separators should be designed and sized in accordance with the King County Surface Water Design Manual.

Oil/water separators must be checked at least weekly during the wet season. How often material should be removed depends on the amount of petroleum in the influent, but the separator should be cleaned at least quarterly, and particularly in the fall before the first storm of the wet season. All residuals removed from the surface and vault bottom must be disposed of properly. In addition, the following maintenance requirements apply:

- Oil absorbent pads should be replaced as needed, but should always be replaced in the fall prior to the wet season, and in the spring.
- The effluent shutoff valve is to be closed during cleaning operations.
- Waste oil and residuals shall be disposed in accordance with current Seattle-King County Department of Public Health requirements. Several vendors handle waste oil hauling and disposal.
- Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at a discharge location approved by the local government.

Catch Basin Insert

APPLICATION AND DESCRIPTION

A catch basin insert is a device installed under a storm drain grate to provide water quality treatment through filtration, settling, or absorption.

Catch basin inserts are commercially available products which fit into existing catch basins and are generally configured to remove one or more of the following contaminants: coarse sediment, oil and grease, and litter and debris. While it has been suggested that some units may be able to remove dissolved pollutants and pollutants associated with fine sediments, King County is not aware of independent tests which have confirmed this. Catch basin insert technology, however, is rapidly changing and future products may be able to remove dissolved pollutants. When selecting a system, ensure that your specific pollutant-removal needs are met. As with any treatment BMP, catch basin inserts should never be used in place of sound source control practices.

Oil and Grease Removal: Inserts designed for the removal of oil and grease contain, and depend on, oil-absorbing media. These inserts are appropriate for use in any area in which vehicles are used or stored. Because of the small storage capacity of the these inserts (about 1 quart of oil under ideal conditions) they are not acceptable as the sole line of defense against actual oil spills in areas where larger amounts of oil could be released. Large amounts of sediment entering the catch basin significantly reduces the effectiveness and longevity of the oil absorbing media. Under these conditions, an oil/water separator with a pre-settling chamber, may be more appropriate.

<u>Sediment Removal</u>: Inserts designed for sediment removal may be used at construction sites, and in situations where stockpiles or unpaved areas are likely to contribute high sediment loads. They may also be appropriate for small (low traffic) businesses in which the per-inlet cost of cleaning would be excessive. Tests indicate that these units do little to remove fine materials and dissolved pollutants and should not be considered a substitute for other pollutant-removal BMPs.

<u>Debris Removal</u>: Inserts can also be used for the removal of litter and debris. Some evidence suggests that the removal of large debris such as cigarette butts, candy wrappers, and beauty bark reduces the amount of harmful bacteria in receiving waters.

DESIGN AND MAINTENANCE

Unlike most other treatment BMPs, which must be designed and constructed specifically for your site, catch basin inserts may be purchased directly from a vendor and installed by the user. While standardized units are available, most vendors are able to customize their systems for your site. This service may dramatically improve the performance of your system while adding relatively little to the cost of the product. Before purchasing a catch basin insert, the following factors must be considered.

Conveyance Capacity: The conveyance capacity refers to the amount of water which the system can pass without causing flooding. This capacity is equal to the amount of water which is able to pass through the insert's treatment area, plus the amount which can pass through the built-in overflow structure. As the unit treats the stormwater, the treatment area begins to clog and the total conveyance capacity is reduced. If maintenance is neglected, or an unusually high amount of sediment or debris enter the system, the <u>treatment</u> capacity may drop to zero, and all of the water will have to exit through the overflow. In order to minimize the chance of flooding, the insert should be able to pass the maximum expected flow from the area draining to the catch basin. In most cases the vendor should be able to tell you what the overflow capacity is.

<u>Treatment Capacity and Bypass</u>: The treatment capacity refers to the amount of water which the unit will pass through its treatment area. The unit should be sized to ensure that most of the water entering the drain-inlet is treated even as the treatment area starts to clog. The ability of the unit to remove pollutants will be reduced if water is able to seep between the storm-drain grate and the edge of the pavement. Ensure that this gap is sealed. The vendor should provide you with information on how to prevent this situation and information on the treatment capacity of the system.

<u>Maximum Weight</u>: The maximum weight of the filter will be equal to the weight of the unit when new, plus the weight of the sediment and water trapped in the unit. Under the most extreme cases, the treatment area of the unit may become completely clogged, and the unit may be full of water when it comes time to service it. It is essential the maximum weight of the unit be less than what can be lifted by the people or equipment to be used during maintenance. Before ordering a system, or having a system customized to your site, be sure the vendor knows how you will be removing the unit for maintenance.

<u>Simplicity and Durability</u>: Since the installation of one or more catch basin inserts represents a long-term commitment to maintenance, it is important that the unit selected be easy to use and maintain, and that it is built to last. Be sure to have the vendor provide a complete demonstration of the product at your site, and if possible, ask to try a unit for a month or so before committing to its purchase and use.

Catch basin inserts will generally require more frequent, but less costly maintenance than other treatment BMPs. Frequent inspection of the units is necessary to ensure that they are not clogged by large debris. Actual maintenance will generally consist of removing the unit from the catch basin, cleaning or replacing the filter media (if applicable), and re-installing the unit. In addition to the weight considerations mentioned above, you must

insure that the drain-inlet will not be obstructed when it is time to clean the filter, that you have the time and personnel to do the job (or can arrange for this service through a private contractor), and that you have a legal means of disposing of the trapped material and spent media. In most cases these materials may be disposed of as regular solid waste, however, media used for oil and grease removal may require special treatment. See BMP Info Sheet 2 in this chapter and resources in Chapter 6 for more information on disposal.

Maintenance frequency will vary depending on the amount and type of pollutant targeted. Tests conducted by King County suggest that initially, all units should be inspected every one to two weeks (except during periods of dry weather), and that complete maintenance will be required approximately monthly. Units configured simply to catch litter and debris may work for several months without maintenance. The simplest way to determine whether the units need maintenance is to inspect them during a rainstorm and see whether water is exiting out the overflow. If this is the case, the unit is probably in need of service. Alternatively, the depth of sediment accumulation or appearance of the filter media, may provide insight as to whether the unit is in need of maintenance. Again, be sure the vendor provides you with this information.

Catch Basin Sump and Vault Filters

APPLICATION AND DESCRIPTION

Catch basin sump and vault filters are devices installed underground to provide water quality treatment through filtration, settling, or absorption. These are similar to, but larger than catch basin inserts.

At this writing, several new but unproved technologies are being developed which are based on the installation of a filter media wall or cartridge in a catch basin sump, pipe system, or existing vault. The fundamental difference between these systems and the catch basin insert, is that sump and vault filters take advantage of the natural settling characteristics of the existing drainage system. By allowing coarse sediment to settle out before reaching the filter surface, the life of the filter will be increased (in catch basin inserts, however, the filtering media is subject to the entire sediment load and tend to clog after only a few inches of rainfall. In addition, the volume available to catch basin inserts is generally limited to about two cubic feet, further limiting their ability to remove sediments and sediment-related pollutants).

Sump and vault filters used so far have been designed to remove oil and fine sediments. Currently, efforts are under way to develop filter media to remove dissolved metals and nutrients. However, these options are not likely to be available for several years. While very little performance information exists on sump or vault filters, the likelihood that new products will be developed, and the strong interest on the part of both government agencies and pollution-control firms, makes them worth considering. Those considering these space saving, and potentially low-cost options, should contact the Surface Water Management Division for information on the latest technology.

DESIGN AND MAINTENANCE

All of the design considerations regarding filtration capacity, overflow capacity, and media selection which were discussed in BMP Info Sheet 9 - Catch Basin Inserts apply to sump and vault filters. In addition, the variety of conditions in the drainage systems in which these systems could be installed requires that care be taken to ensure the more generic versions of this technology will function properly. The ability of the absorptive media to survive extended periods of immersion must also be considered.

Maintenance of sump and vault filters will generally be more difficult, but less frequent, than for catch basin inserts. While systems installed in the sump of a Type 1 catch basin may be maintainable from the surface, those installed in larger catch basins and vaults will need to be maintained by persons trained in and equipped for confined-space entry. Under no circumstances should an individual enter a tank, vault, or manhole without appropriate training and equipment.

Leaf Compost Filters

APPLICATION AND DESCRIPTION

Leaf Compost Filters are a filtering structure that is installed above or below ground and uses leaf compost to remove pollutants from stormwater.

Leaf compost filters are commercially available products which provide three modes of removal: filtration, ion exchange, and adsorption. They are best used to remove moderate concentrations of particulate pollutants and oil and grease. They are particularly effective in removing metals and some organic pollutants. Leaf compost filters should NOT, however be used in areas where nutrient loadings are a concern. These filters release dissolved phosphorous and are not a good choice if the business is located in the watershed of a phosphorous sensitive lake.

Above ground leaf compost systems can be used to treat runoff from small or large sites. As such, they are recommended for use in redevelopment projects. Below ground leaf compost filters are also well suited in urban areas where land surface constraints are important, since they require relatively little surface area of compost filter media.

DESIGN AND MAINTENANCE

Leaf compost filters should be designed, sized, and maintained in accordance with the King County Surface Water Design Manual. They should be located in areas that are easily accessible for routine maintenance and inspection. The filters should also have adequate maneuvering area for replacement of the compost media. Replacement usually requires the use of a backhoe for above ground filters and a vactor truck for below ground filters.

Leaf compost filters are subject to clogging by fine sediment and other debris. At a minimum the facility should be inspected every three months during the first year of operation. Based on these findings, the intervals of inspection may be reduced to every six months. In all cases, the facility shall be inspected and maintained after each significant storm event.

Wet Pond, Wet Vault, or Constructed Wetland

APPLICATION AND DESCRIPTION

A wet pond, wet vault, and constructed wetland are facilities that maintain a permanent pool of water for removing settleable solids, particulate pollutants, and some dissolved pollutants from incoming stormwater runoff.

A wet pond is a basin with a permanent pool of water to enhance pollutant removal. In a wet pond, wetland vegetation may grow along the pond edge. A constructed wetland is heavily vegetated along the edges and through the center of the pool. The pool depth in a wet pond typically ranges from three to six feet, but is much less in a constructed wetland. A wet vault is essentially an underground pond with walls, and without vegetation. Because of the lack of vegetation, a wet vault is incapable of removing dissolved pollutants.

A wet pond and constructed wetland are large facilities requiring a considerable amount of space. A wet vault, however, is an underground system, less dependent on above ground area.

At existing businesses and public agencies, wet ponds and constructed wetlands will likely only be used when the site has an older stormwater detention pond which has the appropriate characteristics for conversion. Underground detention pipes can also be converted to wet pipes (becoming a wet vault). A new wet vault is probably the most suitable system for businesses that do not have a detention facility or where the detention facility cannot be converted to treat stormwater.

Numerous field studies indicate these systems are able to remove the majority of the settle-able solids and particulate pollutants in stormwater. The amount of pollutants removed is directly related to the size of the pond. Some dissolved pollutants are probably removed although the data are too limited to draw definitive conclusions. Although these three BMPs have the potential to provide different levels of treatment, particularly in regard to dissolved pollutants, they are placed together because there is insufficient data to distinguish their performance at removing pollutants.

DESIGN AND MAINTENANCE

These facilities are to be designed in accordance with the *King County Surface Water Design Manual*, if possible. If the site already has a detention facility, it may be possible to convert it to a treatment BMP.

Regarding maintenance, follow standards specified in the King County Surface Water Design Manual. Studies have indicated that bottom sediments will typically not reach hazardous levels necessitating special disposal arrangements.

Vegetated Biofilters

APPLICATION AND DESCRIPTION

A vegetated biofilter is an earthen channel, strip, or swale in which pollutants are removed from stormwater by filtration through grass, settling, and infiltration through soil.

There are two general configurations of vegetated biofilters: *swale* and *strip*. A swale is a long, gently sloped ditch or depression designed to treat water as it passes through the vegetation. Grass is the most common vegetation although wetland vegetation is used if higher water tables or base flows are encountered. A filter strip treats sheet flow and is placed parallel to the contributing surface. Grass is the most common vegetation, although emergent wetland vegetation is sometimes used.

Field studies in western Washington have shown that well maintained swales will remove the majority of the suspended solids and particulate pollutants. They may remove some dissolved pollutants, but field data are too limited to draw definitive conclusions. Heavy oil producing sources should be first treated with other oil control BMPs before runoff is directed to vegetated biofilters.

Vegetated biofilters will likely see limited application for retrofitting existing businesses. In some cases it will be possible to convert landscaped areas to biofilters. Roof drains that are currently piped directly to the storm drain could be modified to discharge to the grassed areas next to the building and then to a catch basin located in the grassed area. Some parking lots might be reconfigured so that a grass median can be placed over the existing catch basins. Given the appropriate site conditions, vegetated biofilters can complement (but seldom substitute for) source control BMPs.

DESIGN AND MAINTENANCE

These facilities are to be designed, sized and maintained in accordance with the King County Surface Water Design Manual.

A flow spreader at the inlet of the swale may enhance the use of the entire swale width. Bypassing flows above the peak rate of the design storm reduces the risk of damage. Filter strips must only be used where sheet flow of runoff occurs. If runoff becomes concentrated, a biofiltration swale should be used.

End of Info Sheet 13

Sand Filter

APPLICATION AND DESCRIPTION

Sand filters consist of a layer of sand underlain by gravel in which runoff is filtered through to remove pollutants, collected in underground pipes, and returned back to the stream or channel.

Sand filters can be used to remove particulate pollutants, including suspended solids and some metals. They are also able to reduce nutrient levels. They are very adaptable, able to be used in areas with thin soils, high evaporation rates, low soil infiltration rates, and limited space. Sand filters and peat sand filters can be used to treat stormwater runoff from small infill developments and from small parking lots (i.e. gas stations, convenience stores). Sand filters can either be placed in the landscape, with grass grown on top, or in vaults.

DESIGN AND MAINTENANCE

The sand filter should be sized according to the King County Surface Water Design Manual.

Regular maintenance is critical to ensure effective functioning and pollutant removal. Experience with commercial and residential stormwater indicates that the surfaces of sand filters require semiannual cleaning. Failure to periodically clean the filter surface will eventually require replacement of the entire sand bed. Follow standards specified in the King County Surface Water Design Manual.

Infiltration

APPLICATION AND DESCRIPTION

Infiltration uses the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table.

Infiltration systems have traditionally been used only in highly drained soils for handling excess runoff quantity. They have more recently been applied to runoff treatment situations. Infiltration of stormwater through soil can be effective at removing most pollutants, however, for the soil to be able to treat runoff and capture pollutants, one of three situations must exist: 1) the soil must be fine-grained, 2) it must have a high organic content, or 3) it must have a high cation exchange capacity.

Infiltration facilities can be either ponds or vaults which may be used on small to large developments. It is also possible to use modular pavement or concrete grid for infiltration on smaller sites. Modular pavement and concrete grid are lattice grid structures with grassed, pervious material placed in the openings where water can thus drain through the open areas of the grid into the soil below. Porous and grid pavements can only be used in areas with no traffic or low-volume parking.

There are two different retrofit situations to consider. The first situation is a development that is currently disposing stormwater to an infiltration system without pretreatment, which due to circumstances is degrading groundwater quality. Pretreatment of the stormwater is essential for coarse soils to protect groundwater quality, and for finer soils to avoid premature clogging of the infiltrative surface. The other treatment BMPs presented in this chapter can be used for pretreatment to resolve this problem.

The second situation is a development which currently disposes its stormwater to a piped system, but its soils are suitable for at least partial infiltration. Again, soil type plays an extremely important role in the performance of infiltration systems. To have the characteristics listed above, soils must contain loam and/or fine sand and silt.

An infiltration system is not appropriate at industrial sites where spills of hazardous chemicals may occur unless strict controls are in place that prevent spills from reaching the infiltration system.

DESIGN AND MAINTENANCE

Infiltration systems for water quality are to be designed and maintained in accordance with the King County Surface Water Design Manual. Porous pavement is not discussed in the Surface Water Design Manual, but maintenance should be to vacuum-sweep and pressure wash frequently (quarterly is suggested).